Wybunbury Moss

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Introduction

Wybunbury Moss is an outstanding example of a deep basin mire of 'schwingmoor' structure. A schwingmoor is a floating peat raft where the process of infilling occurs by the formation of a *Sphagnum* raft over open water and the gradual settling down of the basal layers of this raft into the water to give a very fluid structure. The site comprises an enclosed basin containing some 4 m of oligotrophic peat overlying up to 16 m depth of water. The history and development of the mire have been studied using a combination of pollen stratigraphy, macrofossil and chemical analyses. The results suggest that subsidence of the basin probably is the result of solution of the subsurface salt deposits in the underlying bedrock. Pollen analysis of the peat raft has provided a detailed record of the vegetation history of the site, which, although undated, represents a Holocene transition from fen woodland to *Sphagnum* bog. Poore and Walker (1959) provided a general introduction to Wybunbury Moss, the stratigraphical record of its peat deposits and its modern vegetation. Green (1965) and Green and Pearson (1968) have provided more recent details of the modern ecology of the site and its relationship to movements of the water table, groundwater and water chemistry. Tallis (1973b) has used the lake basins of north Cheshire, including Wybunbury Moss, to illustrate the processes of terrestrialization of lake basins by peat growth.

Description

Wybunbury Moss is a large enclosed basin (approximately 12 ha in area) to the north of the village of Wybunbury in Cheshire. The basin is one of more than 130 peat-filled or water-filled depressions ('mosses and meres') in Cheshire. Green and Pearson (1968) describe the location of the site as occupying a depression in glacial sands, overlying Triassic strata. The Triassic rocks in this area are primarily salt-rich beds of fluviatile Sherwood Sandstone, consisting of sev eral hundred metres thickness of massive deposits of rock salt interbedded with thin marl bands (Evans *et al.,* 1968). Although glacial deposits mostly obscure the bedrock, it is known that natural ground subsidence occurs throughout this area of Cheshire as a result of the solution of the underlying salt-rich beds. Although Poore and Walker (1959) considered that the hollow in which the site lies is best interpreted as a kettlehole, Green (1965) argued for a salt subsidence origin for the depression at Wybunbury Moss. Evidence cited by Green (1965) for this includes the stepped terracing of the basin sides and the absence of organic deposits in the basin sediments earlier than late Zone VI.

The sides of the depression occupied by Wybunbury Moss slope steeply down to the mire on the west and south sides, with gentler slopes on the north side (Figure 8.70). At the eastern end the hollow is open, with the peat at the same level as the surrounding land, approximately 49 m OD. The peat-covered area is roughly oval in shape, measuring 700 m by 300 m, and totalling 12 ha in area. At the margins of the mire there is a sharp delineation between the peat and the well-drained pastures and arable land of the surrounding agricultural area. The mire is almost completely encircled by a perimeter ditch, which is mostly overgrown. Ditches cut into the mire drain into this outer ditch, which then discharges through the south-east part of the site into Howbeck Brook. There is no canalized inflow into the mire system. The surface of the mire is level, and stratigraphical investigations show that over most of its area the peat at Wybunbury Moss is less that 4 m thick. The peat overlies a maximum water depth of 16 m (Figure 8.71).

Surveys of the modern ecology of the site show that four main vegetational units dominate the surface vegetation of the site: marginal mixed woodland, marginal reedswamp, central *Sphagnum* lawn and central pine woodland (Green, 1965; Green and Pearson, 1968). Instrumentation has been installed at the site to monitor vertical changes in the peat raft and movement of the water table (Green and Pearson, 1968). Results show that rises and falls in the altitude of the peat raft are correlated closely to movement of the water table. Seasonal trends include a gradual fall in the level of the water table during spring and summer, but a rapid winter rise. The greatest annual amplitude of raft movement reported over the four years of observations was 10.6 cm. Chemical analyses of the water from the different plant communities, and from sample sites in and around the peat raft, show that the mire vegetation can be divided into two major units according to the mineral content of the water in which it is growing. The reedswamp and mixed woodland communities are supported by waters far more base-rich than the dilute waters of the *Sphagnum* lawn and pine woodland communities (Green and Pearson, 1968). The reedswamp waters contain at least ten times more calcium than those of the central part of the mire.

Poore and Walker (1959) reported the results of a series of borings made at the site, together with pollen analyses of the sediments in a 10.5 m core (Table 8.13). The lower parts of the core are dominated by muds containing arboreal pollen, with abundant *Pinus, Corylus* and *Betula.* Values of *Ulmus* and *Quercus* are relatively low, and *Alnus is* virtually absent. Initially there are high amounts of *Corylus.* Samples collected around the transition from muds to *Sphagnum* peat around 6.50 m in the core contain significant amounts of *Alnus, Ulmus* and *Quercus.* The high levels of *Pinus* in the lower parts of the core decline at around 5.00 m and *Sphagnum* dominates above this level. *Pinus* becomes completely absent above 2.05 m.

Interpretation

The origin of the basin

Two types of basins are common in this area of Cheshire: depressions that originated as kettleholes in glaciogenic deposits during the recession of the last ice-sheet, and those created by more recent subsurface subsidence following solution of salt rich strata. Evans *et al.* (1968) identified two distinct types of subsidence hollow in Cheshire on purely morphological grounds: linear hollows and almost circular subsidence craters. The linear hollows are flat-bottomed and steep-sided, with a maximum width of *c.* 200 m and a maximum depth of *c.* 10 m. The near-circular craters are typically 200–300 m in diameter, also flat-bottomed and steep-sided and with the sides sometimes terraced as a result of intermittent subsidence. Based on levelled profiles, Tarns (1973b) produced more diagnostic criteria for discriminating between those depressions representing kettleholes and those created by subsidence.

1. Basins that originated as kettleholes in the glaciogenic deposits contain organic deposits of Zone N age or earlier. They are small (less that 300 m in diameter), isodiametric or somewhat elongated, steep-sided and with peat depths usually in excess of 5 m.
2. Basins that owe their origin to subsidence resulting from salt solution occupy relatively shallower saucer-shaped depressions. Peat depths in these basins do not generally exceed 3 m and they often contain basal deposits of late Zone VI affinities. These basins are commonly linked to local drainage systems and share the characteristics of these hydrological systems. On the basis of these criteria, Tallis (1973b) agreed with the earlier assertion of Green (1965) that the origin of Wybunbury Moss is the result of underground subsidence following salt-bed dissolution. Infilling of the basin, termed 'terrestrialization' by Tallis (1973b), occurs by the formation of a *Sphagnum* raft over open water and the gradual settling down of the basal layers of this raft into the water (French and Moore, 1986).

The significance of the modern vegetation communities

In mire ecosystems the geographical distribution of plant communities is related closely to the depth and movement of the water table and the chemical composition of the water. Together, these factors explain most of the features of the vegetation at Wybunbury Moss (Green and Pearson, 1968). For example, water table measurements at the site demonstrate that the reedswamp and *Sphagnum* lawn communities can be differentiated from the two woodland communities by their far higher groundwater levels. Those in the central *Sphagnum* community were less than 10 cm below the peat surface, compared with depths of 10–20 cm below the surface in the reedswamp, and depths greater than 30 cm in the mixed woodland community. Apparatus installed at the site (reported in Green and Pearson, 1968) to monitor vertical changes in the peat raft and movement of the water table showed that the two are closely correlated. This buffering of water table fluctuations favours semi-aquatic plants such as *Sphagnum* species and probably accounts for their dominance of the central community. Chemical analyses show that differences in the mineral content of the waters in which these communities exist also are very marked. According to Green and Pearson (1968) these differences result from fundamental changes in hydrology across the site, for example the marginal reedswamp owes its existence primarily to the ingress of mineral-rich surface waters from outside the mire.

(Table 8.13) Stratigraphy and pollen analyses from Wybunbury Moss (compiled from data in Poore and Walker, 1959)

Depth (metres)	Description	Dominant pollen
0.00–0.50	Unconsolidated peat	*Sphagnum*
0.50–0.75	*Sphagnum* peat	*Sphagnum*
0.75–1.26	*Sphagnum* pool peat	*Sphagnum, Calluna,* Gramineae, *Alnus, Quercus*
1.26–1.50	*Sphagnum* peat with rootlets	*Sphagnum, Quercus*
1.50–2.77	*Sphagnum* peat	*Sphagnum, Quercus*
2.77–3.20	*Sphagnum* pool peat with rare *Oxycoccus*	*Sphagnum, Quercus, Betula*
3.20–3.50	*Sphagnum* peat with *Calluna* fragments	*Sphagnum, Quercus, Betula*
3.50–6.50	*Sphagnum cuspidatum* peat with *Oxycoccus* and rare Eriophorum *vaginatum*	Cyperaceae, *Corylus*
6.50–8.80	Coarse detritus mud with *Phragmites, Carex* and *Menyanthes* remains; *Pinus* bark at 7.35 metres	*Pinus, Corylus*
8.80–8.90	Wood fragments	*Pinus, Corylus*
8.90–9.50	*Hypnum* mud with *Carex* and *Menyanthes* remains	*Pinus,* Corylus
9.50–10.00	Woody coarse detritus mud	*Pinus, Corylus*
10.00–10.20	Liquid mud	
10.20–10.40	Woody coarse detritus mud	*Pinus, Corylus, Betula,* Cyperaceae
10.40–10.46	Clay mud	*Pinus, Corylus, Betula,* Cyperaceae
10.46–10.50	Grey clay	*Pinus, Corylus, Betula*

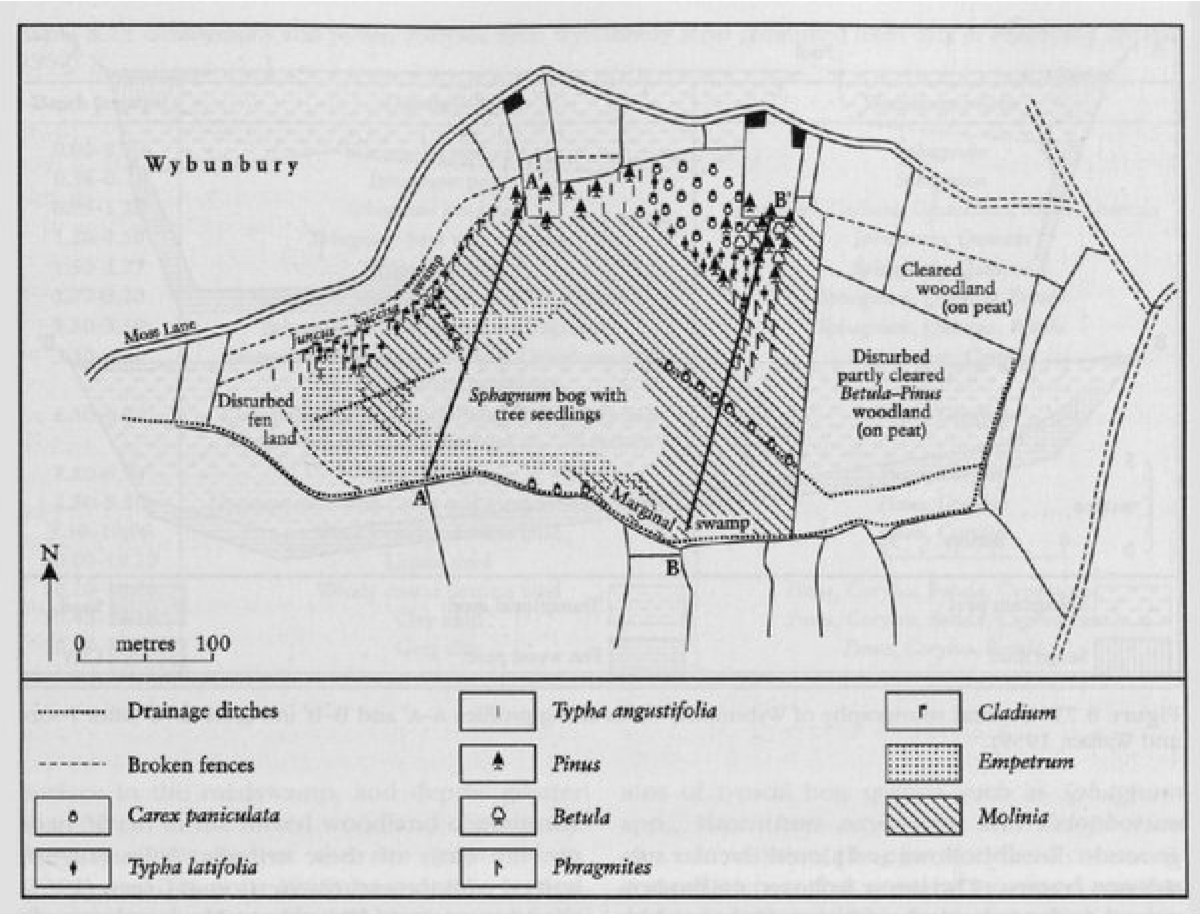
The significance of the pollen stratigraphical record

The pollen record presented by Poore and Walker (1959) shows that the present distribution of the mire vegetation at Wybunbury Moss is a relatively recent development in the history of the mire. The modern reedswamp and mixed woodland communities overlie peat that is oligotrophic in origin and contains abundant remains of typical bog species such as *Sphagnum* spp., *Vaccinium oxycoccus* and *Eriophorum* spp.. In addition, the pine woodland community overlies peat that contains no wood remains and is indistinguishable from that which underlies the *Sphagnum* lawn community. The peat underlying the present vegetation communities is uniform in character, and its palynology indicates that the mire surface in the past was largely covered by open bog vegetation similar to that of the present *Sphagnum* lawn community.

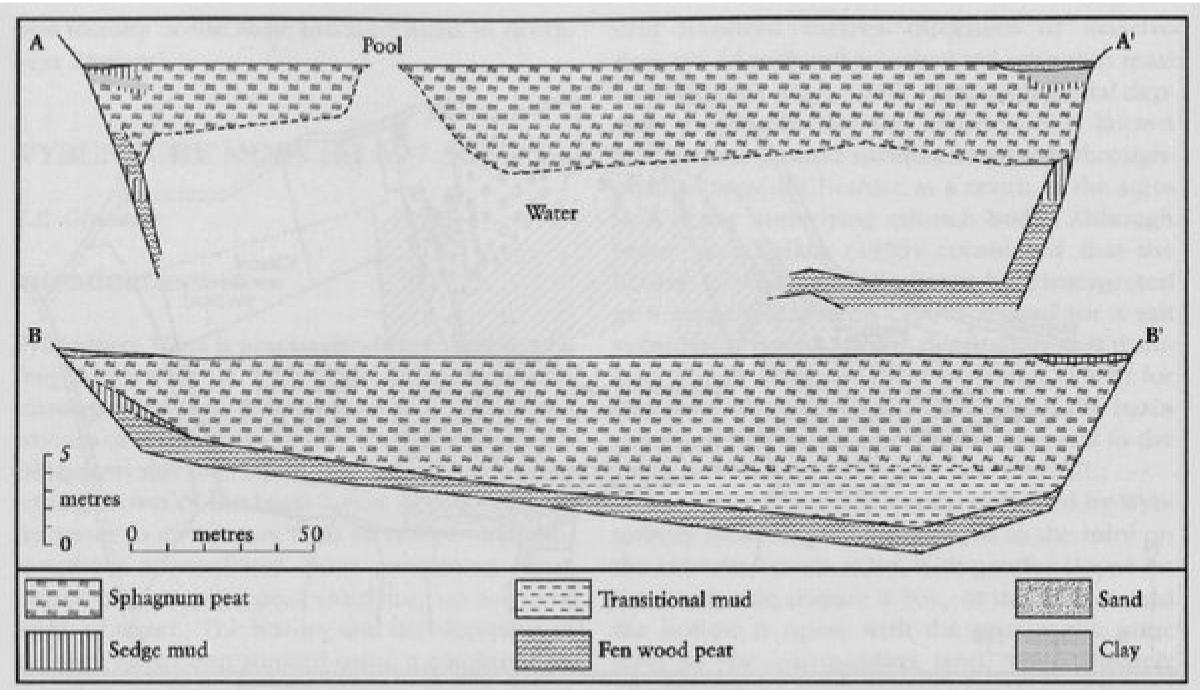
Conclusions

Basin mires with a schwingmoor structure are rare in the UK, and Wybunbury Moss is an outstanding example of this type of feature. The origin of the basin itself is uncertain, but it probably developed as a result of underground subsidence following dissolution of salt-rich beds. Four main vegetational units dominate the modern vegetation at the site: marginal mixed woodland, marginal reedswamp, central *Sphagnum* lawn and central pine woodland. These modern communities are very different to those observed in the palynological record obtained from the site, which is dominated by open bog vegetation similar to that of the present *Sphagnum* lawn community. The pollen stratigraphy of the site shows that the earliest organic deposits are typical fen woodland communities, probably dating from Zone VI. At this time, the water level in Wybunbury Moss was around 12 m lower than present. The transition from fen woodland to *Sphagnum* bog is marked by a change in the deposits from wood peat to mud that is rich in sedges, *Phragmites* and *Menyanthes,* suggesting a rise in the water table. Since this time, *Sphagnum* has spread centripetally across the basin to form the present schwingmoor structure. Unfortunately no radiocarbon dates have been obtained from this site so the precise timing of these events remains uncertain.

[**References**](#)



(Figure 8.70) Map of Wybunbury Moss, showing the approximate distribution of the main plant communities and the lines of the transects A–A' and B–B' shown in (Figure 8.71) (after Poore and Walker, 1959).



(Figure 8.71) General stratigraphy of Wybunbury Moss along profiles A–A' and B–B' in (Figure 8.70) (after Poore and Walker, 1959).

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0.00–0.50	Unconsolidated peat	*Sphagnum*
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